Form ESA-B4. Summary Report for ESA-178-2
Public Report - Final

Company	Wausau Paper	**ESA Dates**	10/23/07 to 10/25/07
Plant	Rhinelander, WI	**ESA Type**	Pumping Systems
Product	Paper	**ESA Specialist**	Steve Bolles

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction:
The Wausau Paper Facility in Rhinelander produces technical specialty papers that include high-performance release liners, grease-resistant protective barrier paper and creped tape backing paper.

Objective of ESA:
The goal of the ESA was to apply the PSAT program, associated screening, measurement, and analysis methodologies to several pumping systems in order to:

a) Train plant personnel on the use of the DOE tools and methods
b) Identify savings potential in the selected systems and perform a preliminary evaluation of the cost-effectiveness of implementing projects to reduce energy consumption.

Focus of Assessment:
Before starting the assessment, the pump specialist and facility staff reviewed facility pump systems to determine which pumps would be the best candidates for improvement. Pump systems evaluated included:

- #7 PM Fan Pump
- #6 PM Dry End Pulper Pump
- #9 PM Broke Pulper Pump
- #9 PM High BOD Tank Pump
- #8 PM Clarified White Water Pump
- #9 PM Non-Contact Pump

The facility operates 7 days/week, 24 hours/day.

Approach for ESA:

General

Tim Hasbargen coordinated the Pump ESA effort. ESA participants included Brian Olson, Bruce Olson, Mark Sunnarborg, and John Volharo.

Specific Approach

#7 Fan Pump

Facility staff had collected extensive operating data on the pump system and verified the pump was operating on the pump curve. Based on this data, we were able to develop a system curve and calculated power using the pump equation.

#6 Dry End Pulper Pump

Flow from the dry end pulper pump is controlled with a discharge control valve. Flow is re-circulated continuously and is also adjusted with a partially closed control valve. Pump TDH was determined based on suction tank level and discharge pressure readings with portable pressure instrumentation. Power measurements were taken at the pump MCC using a

Fluke 43 B power quality analyzer. Flow was estimated from the original pump curve. The data was entered into the PSAT software tool to determine existing pump efficiency and evaluate potential system improvements.

#9 Dry End Broke Pulper Pump

Flow from the dry end broke pulper pump is controlled with a discharge control valve. Flow is re-circulated continuously and is also adjusted with a partially closed control valve. Pump TDH was determined based on suction tank level and discharge pressure readings with portable pressure instrumentation. Power measurements were taken at the pump MCC using a Fluke 43 B power quality analyzer. Flow was estimated from the original pump curve based on a 12.5" impeller. The data was entered into the PSAT software tool to determine existing pump efficiency and evaluate potential system improvements.

#9 High End BOD Tank Pump

Flow from the high BOD pump is re-circulated continuously with a 3-way discharge control valve. Pump TDH was determined based on suction tank level and discharge pressure readings with portable pressure instrumentation. Power measurements were taken at the pump MCC using a Fluke 43 B power quality analyzer. Flow into the tank was determined by re-circulating 100% of the flow and measuring the level rise in the tank to determine system flow. The data was entered into the PSAT software tool to determine existing pump efficiency and evaluate potential system improvements.

#8 Clarified Whitewater Pump

Flow from the clarified whitewater pump varies depending on system use. The excess flow is re-circulated using a control valve or directed to the whitewater heat exchanger. Pump TDH was determined based on suction tank level and discharge pressure readings with portable pressure instrumentation. Power measurements were taken at the pump MCC using a Fluke 43 B power quality analyzer. Flow was determined using a Panametrics ultrasonic flow meter. The data was entered into the PSAT software tool to determine existing pump efficiency and evaluate potential system improvements.

#9 PM Non-Contact Pump

Flow from the #9 non-contact pump is varied with a discharge control valve depending on system requirements. Pump TDH was determined based on suction tank level and discharge pressure readings with portable pressure instrumentation. Since the only pressure tap was located downstream of the control valve, we used the PSAT Valve tool to estimate pump discharge pressure. Power measurements were taken at the pump MCC using a Fluke 43 B power quality analyzer. Flow was determined using a Panametrics ultrasonic flow meter.

General Observations of Potential Opportunities:

Electrical cost rate used for analysis purposes (based on 2007 data): 5.0 cents/kWh

<u>General comments and observations</u>

The plant staff was very knowledgeable and helpful during the ESA.

<u>Specific Opportunities Observed</u>

#7 Fan Pump

Facility management was already in the process of pursuing a variable speed drive for the #7 Fan Pump. To help confirm savings and explore alternative cost effective approaches, we performed a flow interval analysis using pump curve and operating data as shown below. This information was used to compare the cost effectiveness of trimming the impeller or applying a variable speed drive.

			Existing			**Trimmed Impeller**			**AC PWM VSD**			
Interval	Hours	Flow	TDH	Eff_P	kW	TDH	Eff_P	kW	TDH	Eff_P	Eff_{VSD}	kW
1	1758	4500	112	70	142	75	70	96	21	84	90	25
2	2628	5500	109	75	158	73	74	108	25	85	91	36
3	876	6500	106	79	173	70	80	113	29	87	92	47
4	3504	8500	97	90	182	57	86	112	38	87	92	80

Based on the above data, reducing the impeller from 21” to 18” would provide annual energy savings of $25,505 with a simple payback of 6 months based on a project cost of $15,000. However, the existing control valve would still be required for flow control.

Based on a full flow of over 13,500 gpm using the existing impeller with a fully open control valve, applying a VSD would still require a smaller impeller to reach the lower flows (4500 to 5500) to prevent motor overheating. Based on the above data, a VSD would provide higher annual savings of $49,704, but a longer payback of 4 years based on an estimated project cost of $200,000.

#6 Dry End Pulper Pump

Based on discussions with facility staff, 90% of the time the #6 Dry End Pulper Pump discharge valve is closed and over 600 gpm is re-circulated continuously through a 50% open control valve to maintain fluid consistency. For this operating mode, facility staff indicated that only 200 gpm is required. Based on PSAT software results, if 200 gpm is provided at a 40’ TDH (conservatively estimated with open control valve) over $17,000 in energy costs can be realized. Since only 5 hp is required for this operating mode, it would not be practical to apply a VSD to the existing 75 hp pump/motor. To realize the projected savings, we recommend installing a small re-circulation pump in parallel with the existing pump that will still be required 10% of the time. Simple payback of this measure is expected to be 1.2 years.

#9 Dry End Broke Pulper Pump

1200 gpm of flow from the dry end broke pulper pump is controlled with a 20% open discharge control valve and a 50% open recirculation control valve. Based on discussions with facility staff, it was determined that only 300 gpm is required for system requirements and 400 gpm is needed for recirculation to maintain fluid consistency. To determine system head requirements, the discharge valve was fully opened to obtain a conservative discharge pressure of 44 psi (improved system flow will have a lower pressure). This data was entered into the PSAT software tool to determine the potential savings of reducing total head by 90’ and flow by 500 gpm. The projected annual savings of $20,000 can be realized by installing a variable speed drive on the existing pump/motor with a fully open control valve and using the re-circulating control valve to maintain the 400 gpm of re-circulating flow. Simple payback is expected to be 1.8 years.

#9 High End BOD Tank Pump

Normal operation for the high BOD tank pump is to maintain the 3-way discharge control valve at 50% open and re-circulate flow continuously. To determine flow required by the system, the control valve was positioned to re-circulate 100% of the flow and the level rise in the tank was measured. Based on this test, a system flow requirement of 210 gpm was determined and a recirculation rate of 230 gpm was estimated based on the pump curve. Facility staff indicated that recirculation flow is not required to maintain fluid consistency. Using the PSAT tool, we determined potential annual savings of $5,800. For this system, a variable speed drive will help the facility realize these savings while providing the flexibility to increase flow if needed. Simple payback for this improvement is expected to be 3.4 years.

#8 Clarified Whitewater Pump

During field testing, a system flow rate of 960 gpm was determined using a portable flow meter. Based on discussions with facility staff, this is higher than expected since original system design data indicates a flow rate of 200 gpm using a 20 hp pump/motor. Although at this time the majority of the total pump flow is being delivered to the system, an end use review is recommended to determine where the water is being used. If the facility can prevent un-necessary flow and bring the flow and pressure back to original design standards, over $13,000 in annual energy savings could be realized (based on PSAT results). We recommend installing a new pump equipped with variable speed drive to match system requirements. Simple payback is expected to be less than 2.3 years.

#9 PM Non-Contact Pump

The non-contact pump provides supplemental flow to the filtered water system. With this arrangement, the pump must maintain a minimum pressure of 45 psi. This pressure was used as an equivalent static head value when developing the system curve. Based on discussions with facility staff, we were able to determine hours at various flow profiles and used the existing pump head curve to determine how efficiency varied when flow was changed using the existing control valve versus using a variable speed drive to adjust flow on the developed system curve. A summary of the data used is provided below.

			Existing			AC PWM VSD			
Interval	Hours	Flow	TDH	Eff_P	kW	TDH	Eff_P	Eff_{VSD}	kW
1	1752	420	205	42	41	120	55	90	20
2	3504	800	190	65	46	125	65	91	34
3	2628	1000	183	72	50	130	70	92	40
4	876	1250	175	74	59	140	73	93	51

Based on the above data, we determined annual energy savings of $5,606 using a variable speed drive. Simple payback is expected to be over 6 years.

Other Opportunities

Although this ESA focused on facility pump systems, we reviewed the facility wastewater system aeration blowers that appeared to be oversized for system needs. We recommend working with the blower manufacturer to determine the cost of changing/removing impellers to downsize one of the existing blowers. Improvements should also include reviewing the cost effectiveness of improving the dissolved oxygen control system. This project is expected to have a simple payback of less than 1 year.

Management Support and Comments:

The staff was very supportive of the effort and provided the assistance needed to conduct the assessment.

DOE Contact at Plant/Company:

Tim Hasbargen